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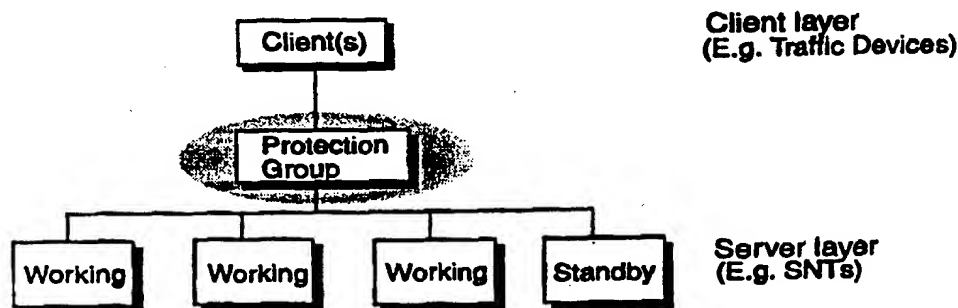
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(54) Title: METHOD AND SYSTEM FOR PROTECTING EQUIPMENT AND SWITCHING FUNCTIONALITY IN A TELECOMMUNICATION SYSTEM



***Protection Group concept, principle***

(57) Abstract

The present invention relates to a method and system for protecting equipment and switching functionality in a telecommunication system, which system comprises a central processor and regional processors, one or more of which is/are standby processor(s), and in order to avoid that the system configuration set by command is changed if protection switching occurs, and in order to provide a flexible concept that allows different types of protection switching methods, there is according to the present invention suggested a solution by introducing a protection group between the existing client(s) and server layers (i.e. switching network terminals), said protection group administering which server units should be working (active) and which should be standby units.

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METHOD AND SYSTEM FOR PROTECTING EQUIPMENT AND SWITCHING  
FUNCTIONALITY IN A TELECOMMUNICATION SYSTEM

5     Field of the Invention

The present invention relates to a method for protecting equipment and switching functionality in a telecommunication system, which system comprises a central processor and regional processors, one or more of which is/are  
10     standby processor(s).

The invention also relates to a system for protecting such equipment and switching functionality.

15     Background of the Invention

Within a switching system there is a requirement that no more than 32 traffic devices are allowed to be affected by a single fault (equipment fault or transmission  
20     fault).

When PCM systems with higher bit rates (above 2 Mbit/s) are being terminated in the telephone exchange, equipment protection and protection switching are required in order to fulfil the requirement above. Equipment protection is  
25     also needed for other types of equipment which control more than 32 traffic devices, e.g. signalling terminals, Access Unit, boards, etc. This means that for the equipment there must exist a standby unit that can take over in case of failure.

30     The Protection Switching mechanisms are specified in references 2-9.

35     With the existing information models in Ericsson's digital telephone exchange AXE, introducing Equipment Protection and Protection Switching causes a number of problems:

- How to connect/define the working & standby equipment?
- 5 - How to notify the operator when protection switching occurs?
- How do we know that the protection mechanisms work?
- 10 - How do we know which equipment is active and which is standby?
- How do we initiate/terminate the protection switching capability?
- 15 - How do we perform manual switching?
- How to handle the traffic devices?
- And a number of other problems.

20

In Figure 1 there is illustrated schematically a principle of an existing information model.

25

In the model illustrated in Figure 1, the EM is the representation of the hardware as seen from the control system (Central Processor and Regional Processors). The SNT is the representation of the hardware as seen from the "application system".

30

A Device is a data record containing data representing a call.

35

DIP is an information element representing the transmission. Only equipment that have a line interface (transmission interface) have a DIP connected.

The invention introduces a new concept "Protection Group"

into the information model in order to control the Equipment Protection & Protection Switching functionality.

5     Known Solutions

There have been presented some ideas of using the existing information model in order to control the Equipment Protection & Protection Switching function.

10    For example the devices are connected to an SNT as before. In addition a new SNT is defined that is supposed to take over the control in case of a failure, see Figure 2 which illustrates a protection introduced at SNT level.

15    One of the problems with such prior art solutions is that the system configuration set by command is changed if protection switching occur.

20    In case of a protection switch the devices are connected to another SNT than originally connected to by command.

It is also very difficult to see which equipment is standby or active, and also difficult to see which equipment forms a protected pair.

25    In addition this solution causes a mixing of functionality on SNT level since the SNTs must also contain the protection mechanisms.

30    With this solution it is also very difficult to make a flexible concept that allows different types of protection switching methods, e.g. 1+1 protection or 1:n protection

35    Further Prior Art

WO95/10146 (Opoczynski/ADC Telecommunications Inc.) relates to backup equipment which will come into operation

if a failure should occur in a telecommunication system. A central processor is used for monitoring the status of a plurality of pairs of telecommunication modules, each pair having an operating module and a standby module.

5 Upon failure the central processor signals to a standby module, which orders switching of all modules being involved, in case a standby module is activated.

10 WO95/224803 (Madonna et al./Excel, Inc.) discloses a programmable telecommunication switch with automatic backup of line cards which provide complete redundancy, namely including multiple I/O busses, standby I/O card and standby line card.

15 WO95/29544 (Li et al./Cisco Systems, Inc.) relates to a system and a protocol for routing data packets from a host on a LAN by means of a virtual address belonging to a plurality of routings. If one of the routers becomes inoperative, a standby router will emulate a new router.

20 US 5 014 261 (Masahiro et al./Fujitsu Limited) discloses a switching system for switching a unit or a plurality of units which are in a first working condition, to one or a plurality of units which are in a standby condition. Upon  
25 failure in one or more of the working units, this unit or units will automatically be connected to a common standby unit.

30 GB 2 294 613 (Bruce/Northern Telecom Limited) discloses a telesystem comprising multiplexed lines, and in order to avoid the problem of having separate line controllers, it is suggested that each tributary channel has an interface towards the multiplexers via a protecting unit, which can switch the tributaries between a first multiplexer and a  
35 second multiplexer when the performance of the system using said first operation multiplexer has been degraded.

However, none of these publications give any instructions for a new "protection group" concept, namely to introduce such a protection group between existing clients (devices) and the level of servers (SNT level).

5

#### Summary of the Invention

The idea of the present invention is to introduce a new concept, here called "Protection Group", that controls the protection switching mechanisms.

10

The idea is to introduce the Protection Group between the existing client and server layers in order to protect the client(s) from faults at the server layer.

15

The Protection Group controls the configuration on server layer with respect to protection mechanisms. This means that the Protection Group administrates which server units should be working (active) and which should be standby units.

20

At the server layer the different server units have their own working state as before, and the units do not have any information about configurations for protection mechanisms.

25

In case of a fault on server layer, this is reported to the Protection Group, which then decides whether to switch to a standby unit or to inform the client that a fault has occurred (i.e. request a blocking of the client).

30

35

In other words, in connection with a method as stated in the preamble, such a method is according to the invention characterized by introducing a protection group between the existing client(s) and server layers (i.e. switching network terminals), said protection group administering which server units should be working (active) and which

should be standby units.

The method may appropriately be implemented when said method comprises the use of a protection group which communicates both with the server(s) (i.e. switching network terminals) and the client(s) or device(s) in question, and which protection group in case of a fault on server layer decides whether to switch to a standby unit or to inform a client that a fault has occurred (i.e. requesting blocking of client).

A system for protecting equipment and switching functionality in a telecommunication system, which system comprises a central processor and regional processes, one or more of which is/are standby processor(s), will accordingly, according to the present invention be characterized in that said system comprises a protection group means introduced between the existing client(s) and server layers (i.e. switching network terminals), said protecting group comprising means for administering which server units should be working (active) and which should be standby units.

Further features and advantages of the present invention will appear from the following description taken in connection with the enclosed drawings, as well as from the appending patent claims.

#### Brief Disclosure of the Drawings

Figure 1 is a block diagram illustrating the principle of an existing information model.

Figure 2 is a block diagram illustrating a protection introduced at SNT level.

Figure 3 is a block diagram illustrating the principle of the protection group concept according to the present



invention.

Figure 4 is a block diagram illustrating an example of the present invention, especially a protection group concept for an SDH ET with MSP 1+1 protection.

Figure 5 is a block diagram illustrating a further example of the present invention, here in connection with an MSP 1:3 protection.

#### Detailed Description of Embodiments

As already stated, Figure 1 illustrates the principle of an existing information model, whereas Figure 2 illustrates an embodiment of a known solution, wherein protection is introduced at SNT level.

Now, turning to Figure 3, there is illustrated the principle of the protection group concept according to the present invention.

From this Figure 3 it is seen that the protection group controls the configuration on server layer with respect to protection mechanisms, which means that the protection group administrates which server units should be working (active) and which should be standby units.

At the server layer the different server units have their own working state as before, and the units do not have any information about configurations for protection mechanisms.

In case of a fault on server layer, this is reported to said protection group, which group will then decide whether to switch to a standby unit or to inform the client that a fault has occurred, i.e. for possibly requesting a blocking of the client in question.

The new Exchange Terminal (ET) for SDH (STM-1, 155 Mbit/s) is used in the text below in order to try to explain the new concept. This is because the Protection Group concept was invented when studying how equipment protection and protection switching could be introduced for this new ET.

The suggested Protection Group concept is general and could be used for any equipment and protection mechanisms within the AXE system.

In connection with SSS (Subscriber Switching Subsystem) it has been seen that equipment protection & protection switching is also needed for Access products.

The Protection Group concept seems to be very well suited in order to solve the problem.

In Figure 4 there is illustrated another example of how the present invention can be implemented, especially in connection with a protection group concept for an SDH ET with MSP 1+1 protection.

Instead of connecting devices (and Digital Paths, if any) to the SNT, they are connected to a Protection Group. Also objects representing Virtual Containers and Multiplex Sections may also be connected to the Protection Group.

Prior to connection of devices and DIPs, and possibly Virtual Containers and Multiplex Sections, the Protection Group has been defined by command.

When connecting/defining the Protection Group it is specified which elements the Protection Group shall consist of (e.g. which SNTs). In addition it is also specified which equipment shall be the standby equipment and which

should be the active equipment.

5 The type of Equipment Protection & Protection Switching to be used is also specified (1+1, n:1, n:m or some other type of protection).

10 In Figure 4 an example of multiplex Section Protection 1+1 is shown. For each STM-1 interface (155 Mbit/s interface) there is a standby STM-1 interface (MS) and also standby equipment (SNT).

15 In connection with Figure 5, an example is given wherein is used Multiplex Section protection 1:n, where n=3. This means that for n STM-1 interfaces there is a standby interface and standby equipment.

20 The Protection Group controls the protection mechanisms and has a number of commands and printouts associated with it in order to:

- 20 - Define the Protection Group, i.e. which equipment/objects that form the Protection Group
- 25 - Define the Protection "algorithm", e.g. MSP 1+1, MSP 1:n or some other algorithm
- State representing the working state of the Protection Group
- 30 - Initiation/Termination of the Protection capability
- Manual Protection Switching
- Printing of configuration data
- 35 - Printing of working state of the Protection Group

- Protection Switch event notifications
- Alarms in case of faults that inhibit the protection switch capability
- Other printouts, e.g. statistics for performance monitoring, such as for example Protection Switch Event Counts, Equipment Protection Event Counts etc.

10 The Protection Group will have its own working state which at any time represents the status of the protection switching capability, i.e. a working state indicating whether the Protection Group is working normally, in protection mode (one of the servers are faulty), manually forced, protected, blocked, etc.

The Protection Group also stores the protection configuration data so that it is easy to see which equipment is the active and standby equipment.

The Protection Group concept can be used for all types of equipment within the AXE.

The Protection Group concept is supposed to be general, and can therefore also consist of other clients than SNTs, for example Access Units (AU), Remote Terminals, Signalling Terminals etc.

Also the client layer can consist of different types of clients, for example traffic devices, Digital Paths, Virtual Containers etc.

#### Advantages

The advantage with Protection Group concept is that Equipment Protection and Protection Switching is controlled in a consistent way for all types of equipment and protection mechanisms.

One set of commands and printouts is used for all types of equipment and protection mechanisms.

5 It is easy to enhance/modify the protection mechanisms without affecting other existing objects within the information model.

10 The model is layered so that neither the objects at the server layer or client layer have to offer mechanisms for protection switching. E.g. an SNT is responsible for supervising its hardware and will behave as before, independent of whether it is working as a single SNT or working within a Protection Group. Of course, the SNT has to know that it has a Protection Group as its server layer.  
15 In case of an SNT fault, this is reported to the Protection Group, which decides whether to initiate a protection switch or not.

20 It is only the Protection Group that knows that the SNT is protected. Also at the client layer the clients do not know whether an SNT is protected or not.

#### Broadening

25 The Protection Group concept was originally invented for SNT handling products (e.g. ETs). However, the concept is general and can be used for any equipment and protection methods as described in this document.

#### References

- 30 [1] ITU-T Recommendation G.782 (01/94)  
"Types and General Characteristics of Synchronous digital Hierarchy (SDH) Equipment"
- [2] ITU-T Recommendation G.783 (01/94)  
35 "Characteristics of Synchronous Digital Hierarchy (SDH) Equipment Functional Blocks"

- [3] ITU-T Recommendation G.803 (03/93)  
"Architectures of Transport Networks Based on the  
Synchronous Digital Hierarchy (SDH)"
- 5 [4] ITU-T Recommendation G.841 (07/95)  
"Types and Characteristics of SDH Network Protection  
Architectures"
- 10 [5] ETSI Draft Specification DE/TM-01015-3-1 (10/95)  
"Transmission and Multiplexing (TM); Generic func-  
tional requirements for Synchronous Digital Hierar-  
chy (SDH) equipment. Part 3-1: STM-N Regenerator &  
Multiplex Section Layer Functions". (Draft for  
ETS 300 417-3-1, approved but not yet printed)
- 15 [6] ETSI Draft Specification DE/TM-03025, version 1.9.  
(09/95)  
"Transmission and Multiplexing (TM); SDH Network  
Protection schemes: Types and Characteristics"
- 20 [7] ETSI Draft Specification DE/TM-03041, version 1.6  
(09/95)  
"Transmission and Multiplexing (TM); SDH Network  
Protection Interworking"
- 25 [8] ETSI Draft Specification DE/TM-03042, version 1.4  
(09/95)  
"Transmission and Multiplexing (TM); SDH Network  
Protection schemes: APS Protocols and Operation"

30

Abbreviations and Terms

AU	Access Unit
EM	Extension Module (The Control System's representation of the hardware)
ET	Exchange Terminal
ETC	Exchange Terminal Circuit

35

	DIP	Digital Path	
	MS	Multiplex Section	
	MSP 1+1	Multiplex Section Protection 1+1	
5		(For each Multiplex Section there is a Standby Multiplex Section)	
	MSP 1:n	Multiplex Section Protection 1:n	
		(For n Multiplex Sections there is a Standby Multiplex Section)	
	PMU	Protection Multiplexer Unit	
10	SDH	Synchronous Digital Hierarchy	
	SNT	Switching Network Terminal	
		(The "Application Systems" representation of the hardware)	
	SSS	Subscriber Switching Subsystem	
15	STM-1	Synchronous Transport Module, level 1	
		(155 Mbit/s)	
	VC	Virtual Container	
20	Devices	Information element that represents a call. There are also devices that represent a "handling device" for a certain function, for example a device handling a continuity check function when setting up a call.	
25			
	Information Model	The information elements the operator can manipulate by commands.	
30			
	Equipment Protection	This means that it is possible to switch to another equipment in case of an equipment fault. I.e. the equipment is protected by a standby unit.	
35			
	Protection Switching	According to ITU-T Recommenda-	

tion G.782 (reference 2) defined as: "the use of pre-assigned capacity between nodes to replace a failed or degraded transport entity". This means that in case of a transmission fault, the traffic is switched to another path.



## P a t e n t   c l a i m s

1. Method for protecting equipment and switching  
functionality in a telecommunication system, which system  
5 comprises a central processor and regional processors,  
one or more of which is/are standby processor(s),  
c h a r a c t e r i z e d by introducing a protection  
group between the existing client(s) and server layers  
(e.g. switching network terminals), said protection group  
10 administering which server units should be working  
(active) and which should be standby units.

2. Method as claimed in claim 1,  
c h a r a c t e r i z e d in that the method com-  
15 prises the use of a protection group which communicates  
both with the server(s) (i.e. switching network ter-  
minals) and the client(s) or device(s) in question, and  
which protection group in case of a fault on server layer  
decides whether to switch to a standby unit or to inform  
20 a client that a fault has occurred (i.e. requesting  
blocking of client).

3. Method as claimed in claim 1 or 2,  
c h a r a c t e r i z e d in that said method com-  
25 prises the use of a protection group which communicates  
with elements which are specified as belonging to said  
protection group, and that said elements comprise a given  
number of for example interfaces (STM) as well as equip-  
ment, especially for multiplex section protection.

30 4. Method as claimed in any of the preceding claims,  
c h a r a c t e r i z e d in that said protection  
group is configured to be used as a 1+1, n:1, n:m or any  
other type of protection.

35 5. Method as claimed in any of the preceding claims,  
c h a r a c t e r i z e d in that said protection

group is adapted to store any relevant protection configuration data, including set-up commands, logs, alarms, etc.

5        6.    System for protecting equipment and switching  
         functionality in a telecommunication system, which system  
         comprises a central processor and regional processes, one  
         or more of which is/are standby processor(s),  
         c h a r a c t e r i z e d    i n    that said system com-  
10        prises a protection group means introduced between the  
         existing client(s) and server layers (i.e. switching  
         network terminals), said protecting group comprising  
         means for administering which server units should be  
         working (active) and which should be standby units.

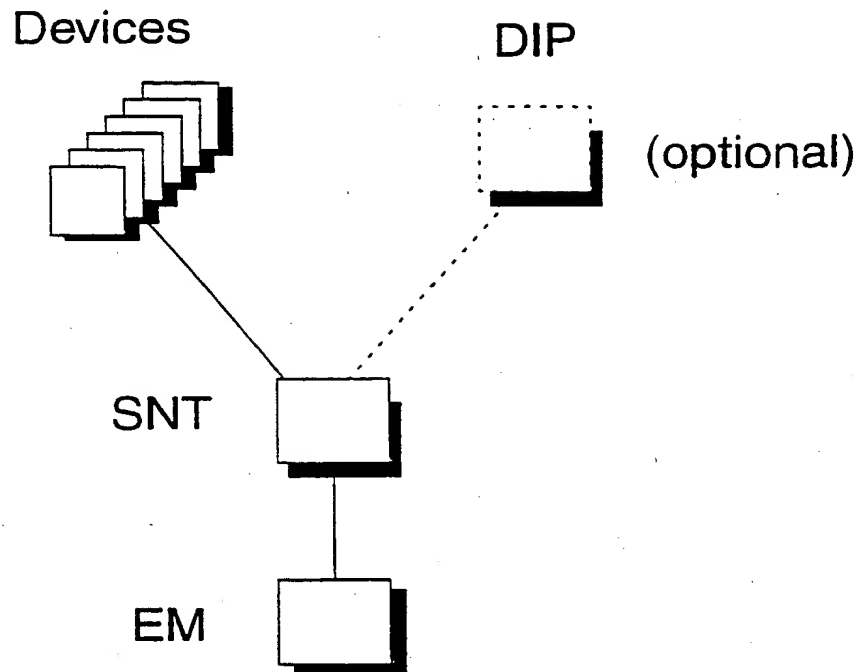
15        7.    System as claimed in claim 6,  
         c h a r a c t e r i z e d    i n    that said protection  
         group means comprises communication means for communi-  
         cating both with the server(s) (i.e. switching network  
20        terminals) and the client(s) or device(s) in question,  
         and that said protection group means comprises decision  
         means for in case of a fault on server layer to decide  
         whether to switch to a standby unit or to inform a client  
         that a fault has occurred (i.e. requesting blocking of  
25        client).

         8.    System as claimed in claim 6 or 7,  
         c h a r a c t e r i z e d    i n    that said protection  
         group means comprises further means for communicating  
30        with elements which are specified as belonging to said  
         protection group, and that said elements comprise a given  
         number of for example interfaces (STM) as well as equip-  
         ment, especially for multiplex section protection.

35        9.    System as claimed in any of the claims 6-8,  
         c h a r a c t e r i z e d    i n    that said protection  
         group means is configured to be used as a 1+1, n:1, n:m

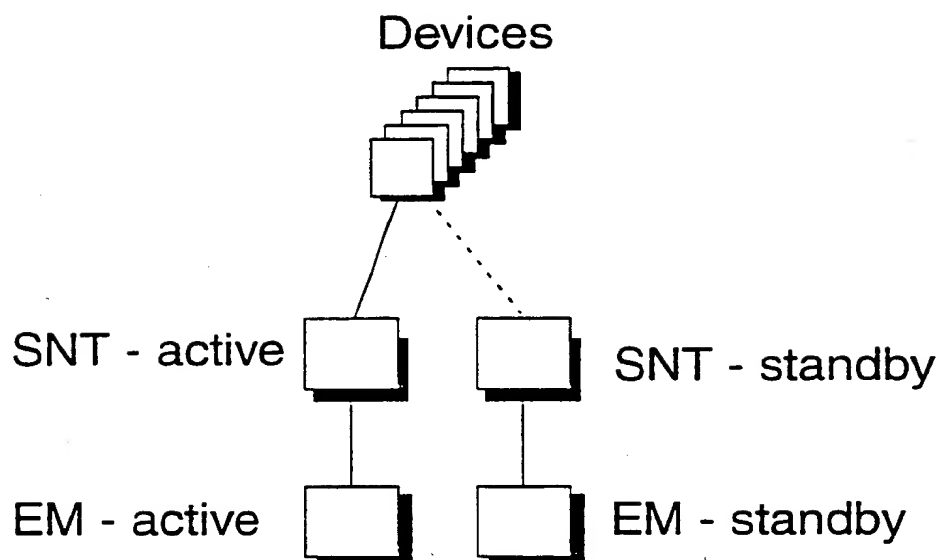
or any other type of protection.

10. System as claimed in any of the claims 6-9,  
c h a r a c t e r i z e d i n that said protection  
5 group means comprises storage means adapted to store any  
relevant protection configuration data, including set-up  
commands, logs, alarms, etc.



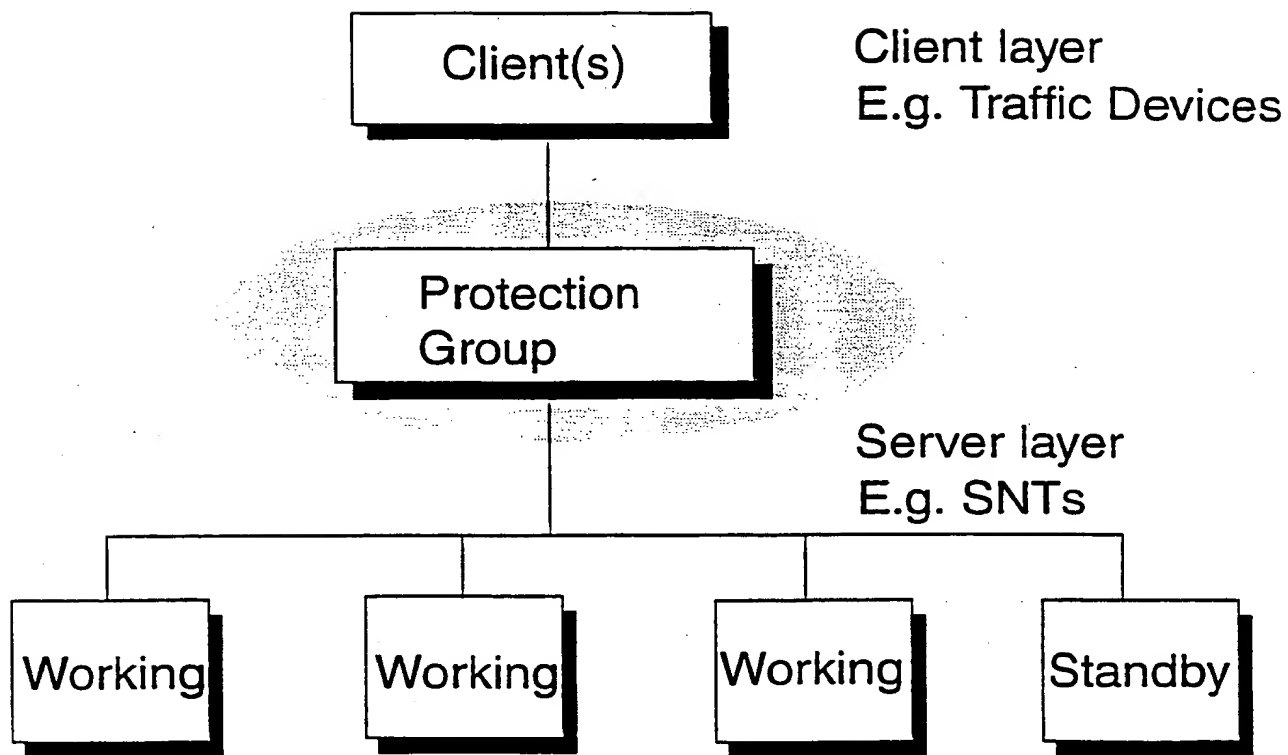
Devices	Data representing a call
DIP	Digital Path
EM	Extension Module
SNT	Switching Network Terminal

*Figure 1. Existing Information Model,  
Principle*

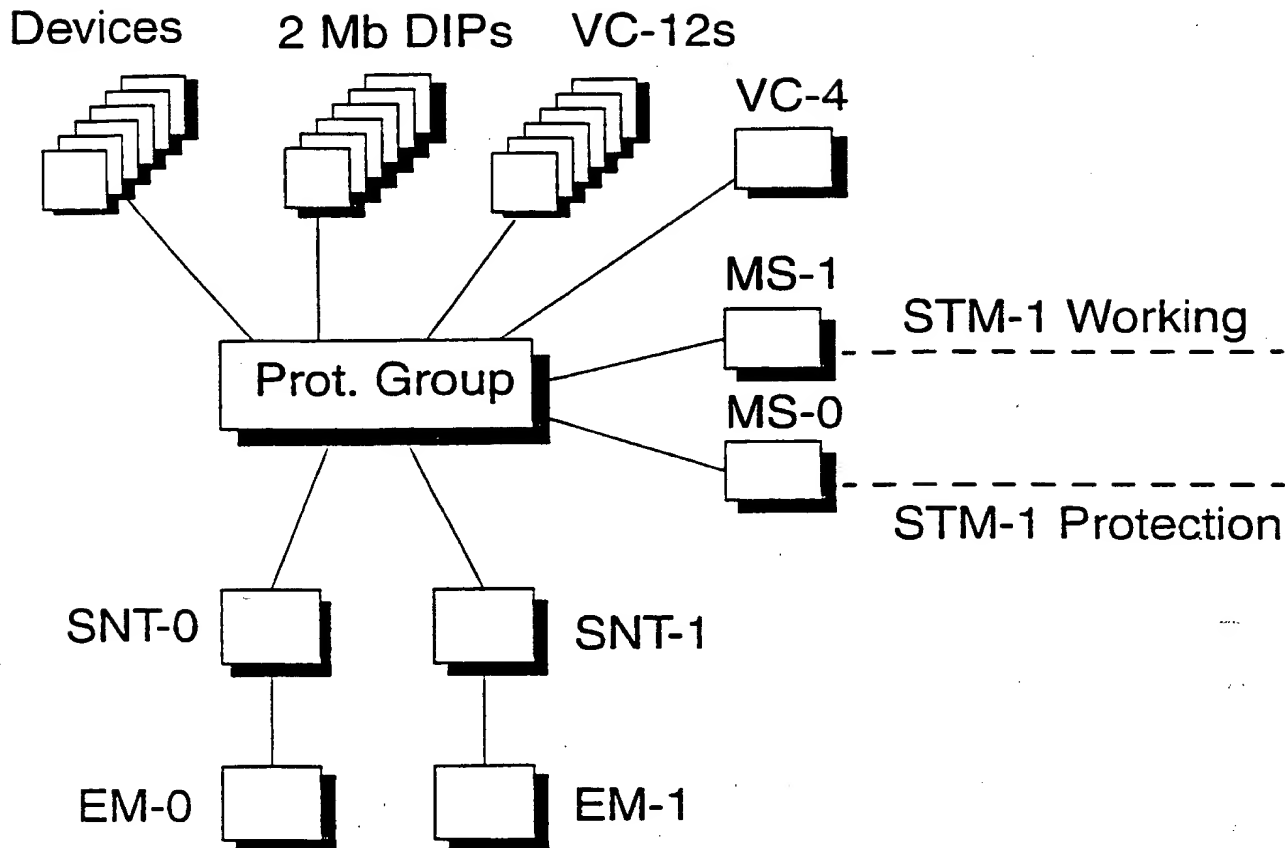


Devices	Data representing calls
EM	Extension Module
SNT	Switching Network Terminal

*Figure 2. Protection introduced at SNT level*



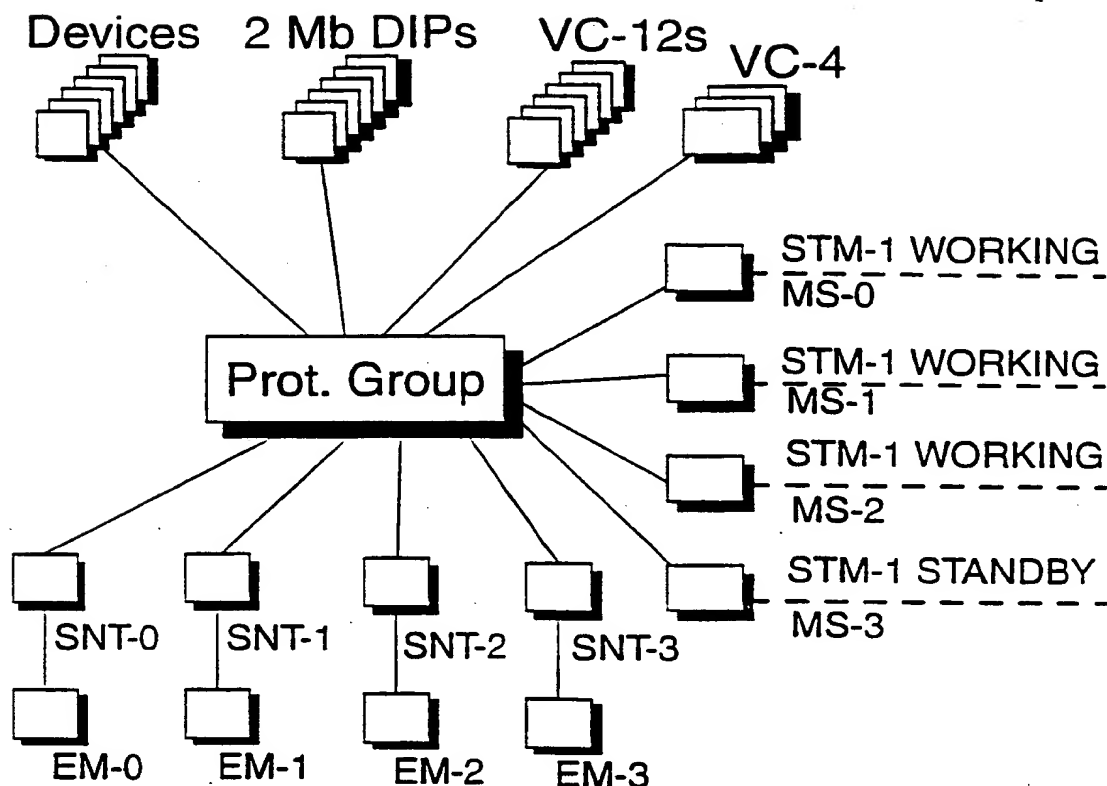
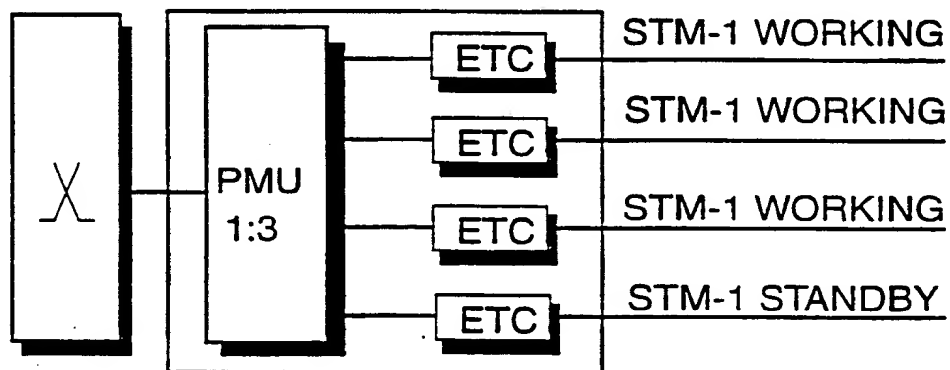
*Figure 3. Protection Group concept, principle*



Devices	Data representing a call
DIP	Digital Path
EM	Extension Module
MS	Multiplex Section
SNT	Switching Network Terminal
VC	Virtual Container

*Figure 4. Example, Protection Group Concept  
for an SDH ET with MSP 1+1 protection*

5/5

Software  
Model:Hardware:  
(example)

Devices	Data representing a call
DIP	Digital Path
EM	Extension Module
ETC	Exchange Terminal
MS	Multiplex Section
PMU	Protection Multiplexing Unit
SNT	Switching Network Terminal
VC	Virtual Container

Figure 5. Multiplex Section Protection 1:3, example



# INTERNATIONAL SEARCH REPORT

International application No.

PCT/NO 98/00032

## A. CLASSIFICATION OF SUBJECT MATTER

IPC6: H04L 1/22, H04Q 11/04, G06F 15/16

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: G06F, H04Q, H04L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	Patent Abstracts of Japan, abstract of JP 8-212095 A (HITACHI LTD), 20 August 1996 (20.08.96) --	1-10
Y	US 5408462 A (OPOCZYNSKI), 18 April 1995 (18.04.95), column 1, line 18 - line 25, claim 1, abstract --	1-10
A	US 5014261 A (SHINBASHI ET AL), 7 May 1991 (07.05.91), column 1, line 10 - line 65, claim 1, abstract --	1-10

☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:	"I" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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Date of the actual completion of the international search	Date of mailing of the international search report
2 July 1998	03-07-1998
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Cecilia Sandell Telephone No. +46 8 782 25 00

## INTERNATIONAL SEARCH REPORT

International application, No.

PCT/NO 98/00032

## C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4382294 A (BEUSCHER ET AL), 3 May 1983 (03.05.83), column 1, line 48 - line 55, abstract  --	1-10
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# INTERNATIONAL SEARCH REPORT

Information on patent family members

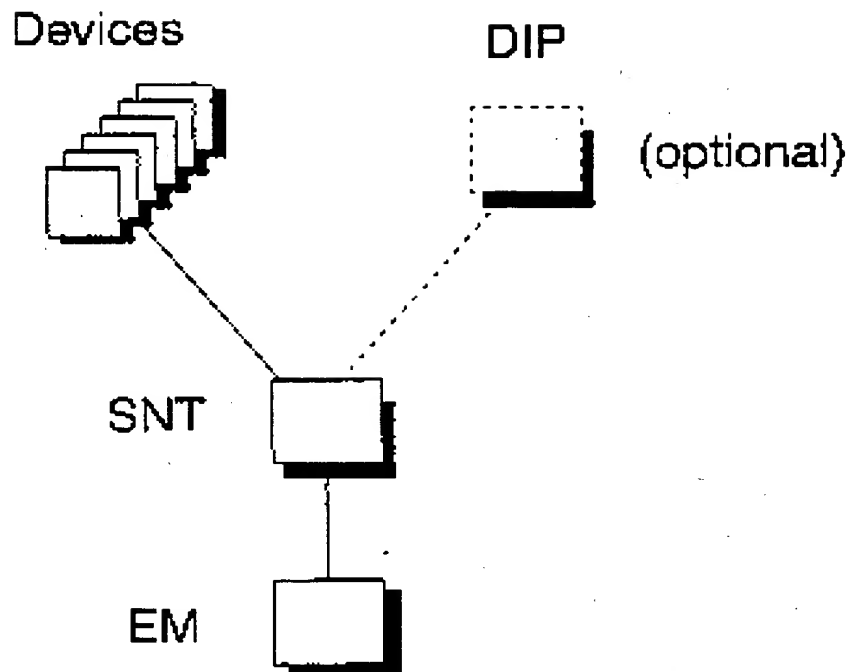
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International application No.

PCT/NO 98/00032

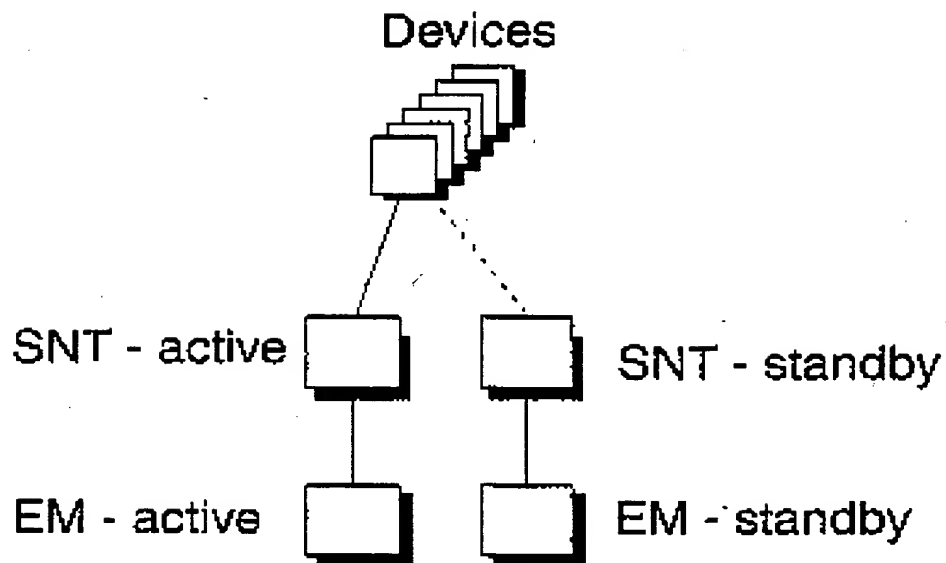
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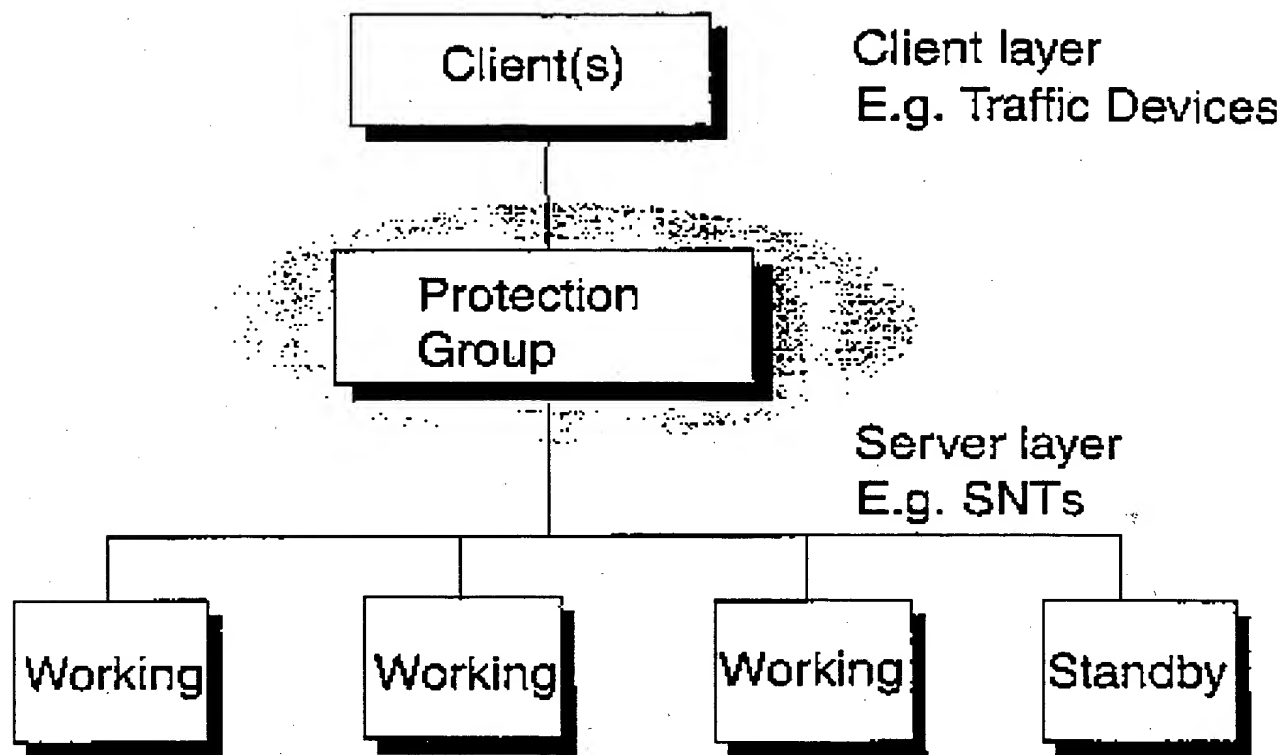
Devices	Data representing a call
DIP	Digital Path
EM	Extension Module
SNT	Switching Network Terminal

*Figure 1. Existing Information Model,  
Principle*

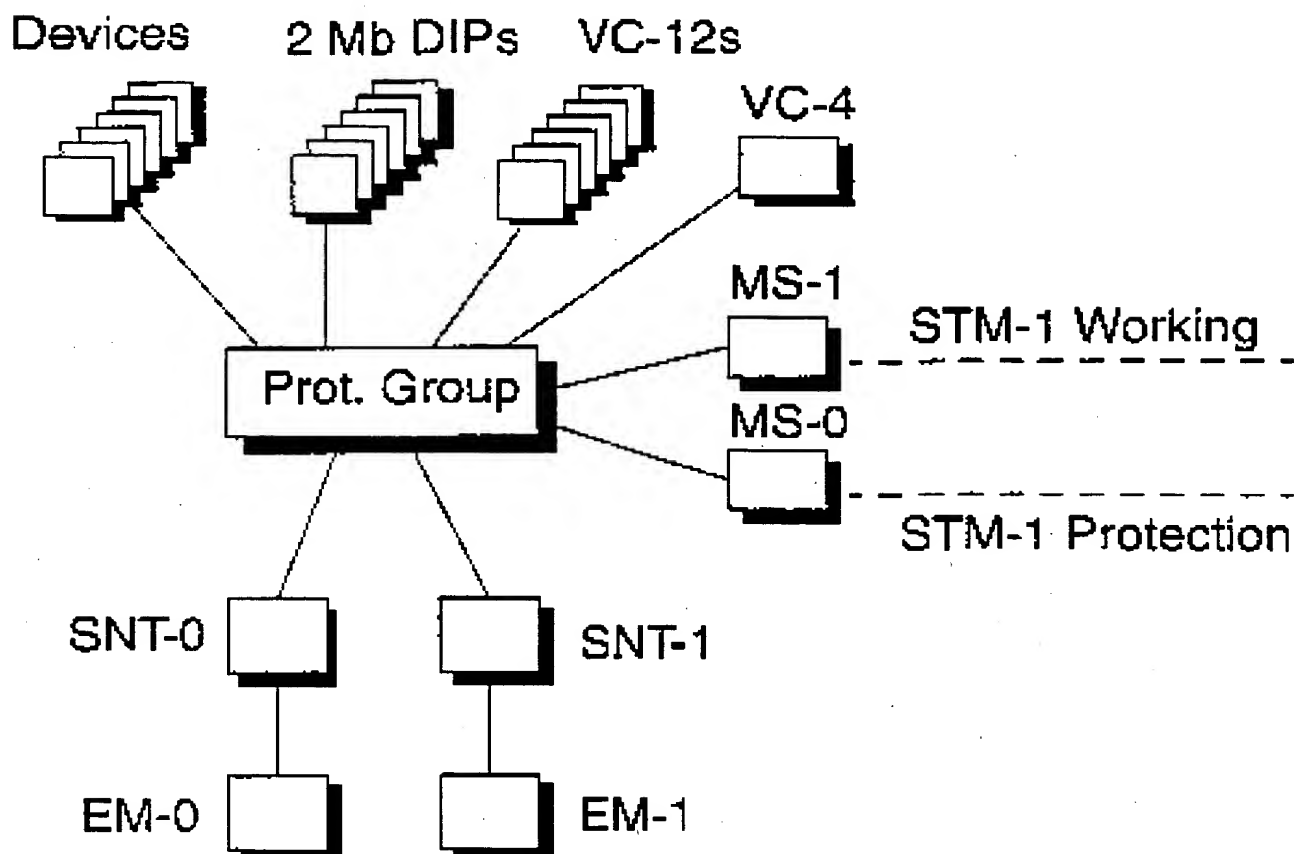


Devices	Data representing calls
EM	Extension Module
SNT	Switching Network Terminal

*Figure 2. Protection introduced at SNT level*



*Figure 3. Protection Group concept, principle*

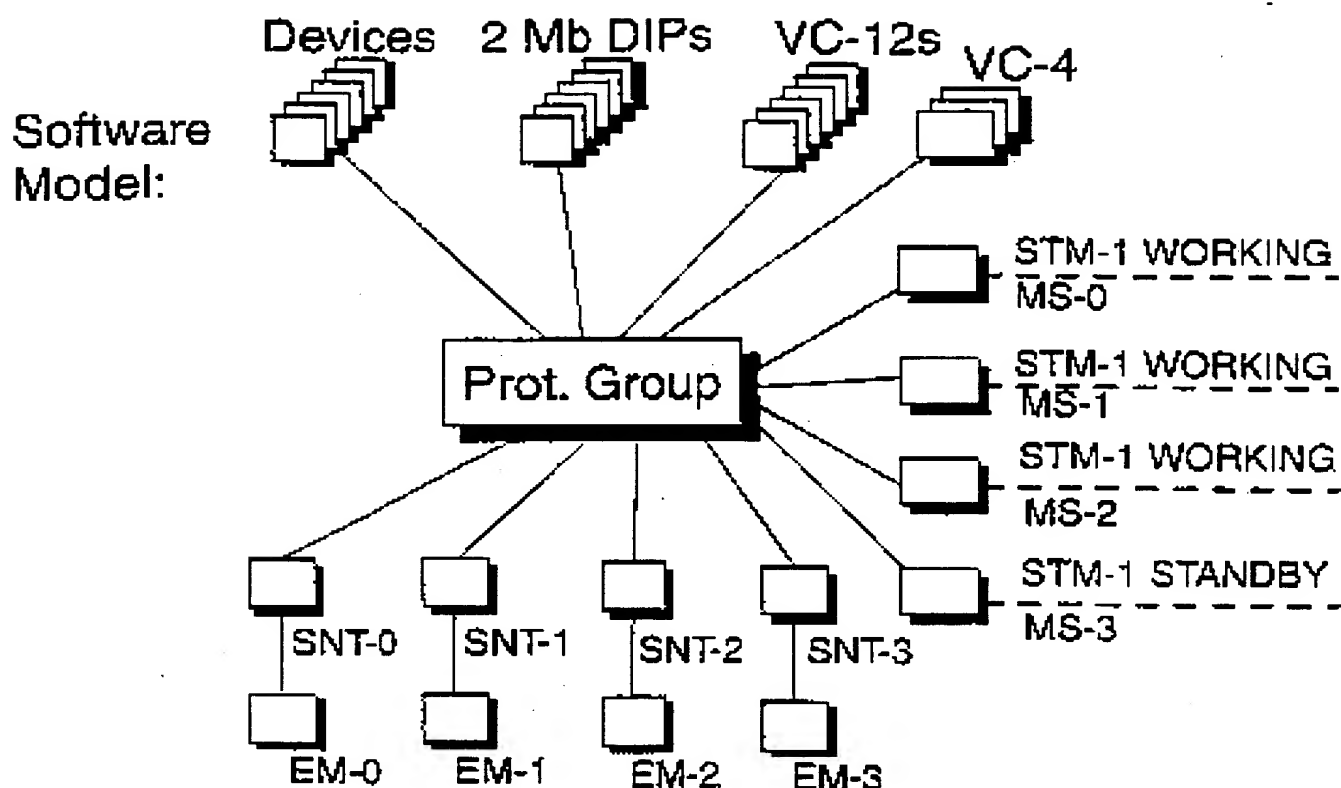


Devices	Data representing a call
DIP	Digital Path
EM	Extension Module
MS	Multiplex Section
SNT	Switching Network Terminal
VC	Virtual Container

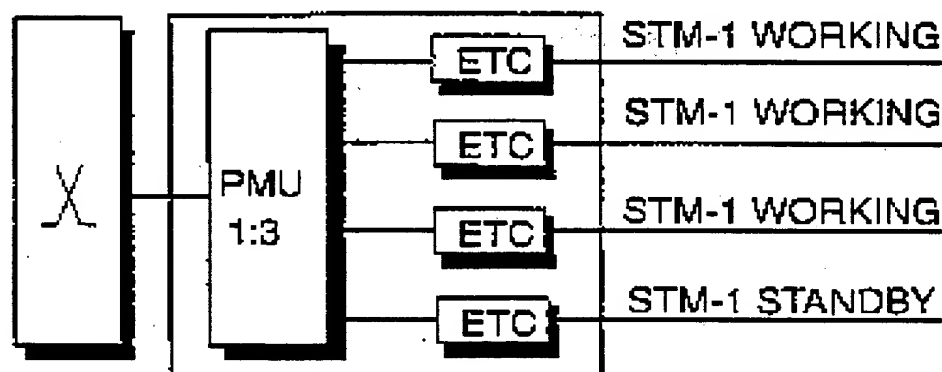
*Figure 4. Example, Protection Group Concept for an SDH ET with MSP 1+1 protection*



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Hardware:  
(example)



Devices	Data representing a call
DIP	Digital Path
EM	Extension Module
ETC	Exchange Terminal
MS	Multiplex Section
PMU	Protection Multiplexing Unit
SNT	Switching Network Terminal
VC	Virtual Container

Figure 5. Multiplex Section Protection 1:3, example

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